BK938 SMD Soldering Station

(This guide was written by Jos Verstraten on 02-05-2018)

Scope of delivery
The BK-938 is delivered in a neat box and internally protected by a sheet of plastic foam, your order survives the rather rigid Chinese way of shipping.



The BK-938 is delivered in a neat box.

The soldering station BK-938
With its dimensions of 5.5 cm width, 8.5 cm depth and 5.0 cm height, the device looks very cute. On the front is a professional ON/OFF switch and a rotary potentiometer for setting the temperature of the soldering iron. With its length of 16.0 cm, the soldering iron lies comfortably in the hand and is connected to the station via a standard tulip plug. Only two wires are connected, it is clear that there can be no automatic temperature control.
The BK-938 is supplied with one soldering tip with a length of 3.4 cm. The tip is clamped around the heating element with a spring and is easy to replace.



The soldering station BK-938.

A very small tip
To give you an idea of the dimensions of the tip, we have kept that tip on one of the connections of an IC in a QIP-80A housing, see picture below. On this housing the pins are only 0.8 mm apart. As you can clearly see, assuming you use very thin soldering tin and have a very steady hand, you can approach the pins one by one without any problems.



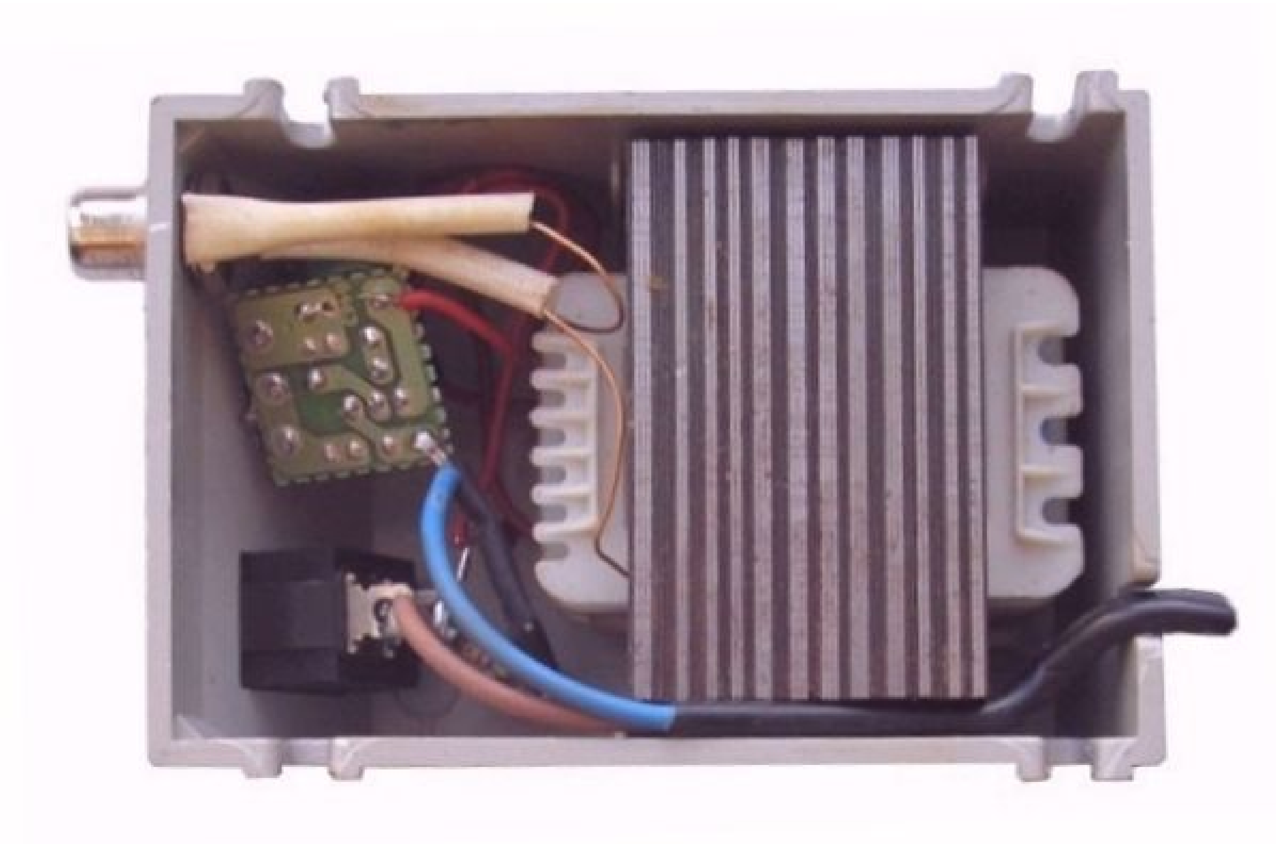
The tip of the soldering iron on one of the pins of a QIP-80A housing.

The specifications according to the manufacturer

- **Mains voltage:** 230 V_{ac} or 110 V_{ac}, please note when ordering!
- **Power supply soldering iron:** 12 Vac
- **Power soldering iron:** adjustable between 1 W and 18 W
- **Temperature pin:** adjustable between 50 °C and 450 °C
- **Warm-up time:** less than one minute
- **Length cable soldering iron:** 75 cm

The electronics of the BK-938

The picture below shows that there is not much technology in it. A small mains transformer and a small PCB, that's all. You can see that the secondary winding of the transformer is directly connected to the RCA tulip connector. The power is therefore regulated on the primary side of the transformer. What is immediately noticeable is the carelessness of the wiring. The mains cable has no strain relief, the secondary winding wire is poorly insulated and can easily make contact with the transformer core, etc.

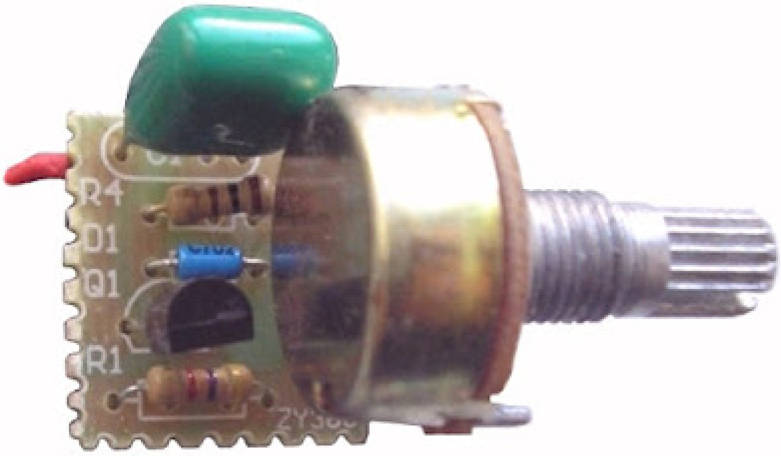


The contents of the housing is pretty sloppy wired.

The PCB

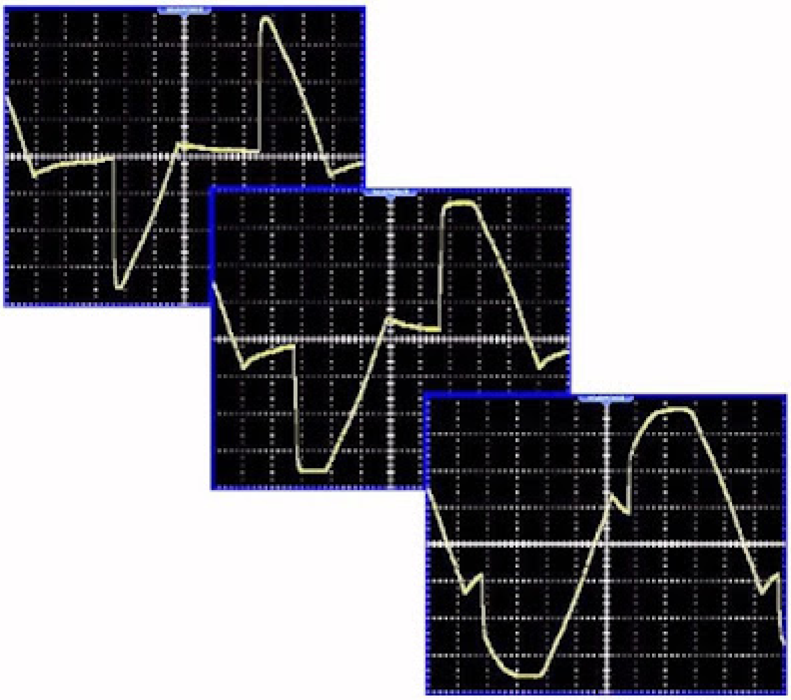
It is obvious to assume that regulating the power supplied to the soldering iron is done via a simple phase cutting control. The in phase cutted mains voltage is connected to the primary winding of

the transformer. After disassembling the PCB, this assumption appears to be correct. One high-voltage capacitor, two resistors, a diac and a 0.8 A Motorola triac of the MAC97A type.



The electronics: a simple triac phase cutting control.

The secondary voltage
What does a secondary transformer voltage look like when it is primarily cut in phase? Not too bad, see the oscillograms below where the secondary voltage with connected soldering iron is shown from left to right for potentiometer positions 0, 5 and 10.



The voltage on the soldering iron at three positions of the potentiometer.

Power control range
In theory, nothing is simpler than measuring electrical power. Power is voltage times current, two ordinary universal meters are switched on and ready to go. This applies to direct voltages and pure sine voltages, but not to the strange voltage and current forms that arise during phase cutting. Fortunately, we have two multimeters of the more expensive kind, which claim that they calculate and display the rms value when measuring voltages and currents. With these meters it must therefore be possible to measure the rms value of the power of the soldering iron. In the table below, the results are summarized for the potentiometer positions 0, 5 and 10. This is quite similar to what the manufacturer promises.

potentiometer position	measured output power
0	1,99 W
5	4,06 W
10	16,52 W

The power of the soldering iron at three potentiometer positions.

Soldering tip temperature

For the three potentiometer settings mentioned above, the temperature at the tip of the soldering iron was measured with a thermocouple. The results are shown in the table below. The temperature range of 50 °C to 450 °C specified by the manufacturer is not achieved. However, the melting point of lead-free solder tin (99.3 % Sn - 0.7 % Cu) is between 217 °C and 240 °C. The tip becomes hot enough from position 5.

potentiometer position	temperature soldering iron tip
0	205 °C
5	260 °C
10	368 °C

The temperature of the soldering tip at three potentiometer positions.